

## CLAIMS

What is claimed is:

- 1 1. A spin valve (SV) sensor comprising:  
126
- 2 a pinned layer having a pinned layer magnetization;  
130
- 3 a free layer disposed adjacent the pinned layer, the free layer having a free  
layer magnetization perpendicular to the pinned layer magnetization in the absence  
4 of an external field;  
128
- 5 a spacer layer disposed between the free layer and the pinned layer;  
124
- 6 a pinning layer disposed adjacent the pinned layer for fixing the pinned layer  
7 magnetization;  
138
- 9 an underlayer disposed adjacent the pinning layer, the underlayer comprising  
10 NiFeX; and  
142
- 11 an upper layer disposed adjacent the underlayer and the pinning layer, the  
12 upper layer comprising a material selected from the group consisting of NiFe and  
13 CoFe for increasing a GMR ratio associated with the SV sensor.

- Subcl> 1 2. The spin valve sensor as recited in claim 2, wherein the upper layer has a  
2 thickness of at least 4 Å. col 8, line 6

- SubAA< 1 3. The spin valve sensor as recited in claim 5, wherein the upper layer has a  
2 thickness of no more than 20 Å.

- Subcl> 1 4. The spin valve sensor as recited in claim 1, wherein the upper layer is doped.

*Subject* 1  
2

5. The spin valve sensor as recited in claim 1, wherein the underlayer comprises  
NiFeCr.

1 6. The spin valve sensor as recited in claim 1, wherein the SV sensor is a  
2 component of a disk drive system. *col 1 lines 21-22*

1 7. The spin valve sensor as recited in claim 1, wherein the underlayer includes  
2 40 +/- 5 Atomic % Cr. *col 1 & lines 1-3*

1 8. The spin valve sensor as recited in claim 1, wherein the pinned layer  
2 comprises a Ru layer. *144*

1 9. The spin valve sensor as recited in claim 8, wherein the pinned layer further  
2 comprises a first CoFe layer disposed adjacent a first side of the Ru layer and  
3 a second CoFe layer disposed adjacent a second side of the Ru layer. *146, 142*

1 10. The spin valve sensor as recited in claim 1, wherein the free layer comprises  
2 a NiFe layer. *150*

1 11. The spin valve sensor as recited in claim 10, wherein the free layer further  
2 comprises a CoFe layer disposed adjacent the NiFe layer. *152, 148*

- SUB A31*
- 1 12. A method of fabricating a spin valve (SV) sensor comprising:  
2 depositing an underlayer comprising NiFeX;  
3 depositing an upper layer adjacent the underlayer, the upper layer comprising  
4 a material selected from the group consisting of NiFe and CoFe for increasing a  
5 GMR ratio associated with the SV sensor;  
6 depositing a pinning layer adjacent the upper layer;  
7 depositing a pinned layer adjacent the pinning layer, the pinned layer having  
8 a pinned layer magnetization;  
9 depositing a spacer layer adjacent the pinned layer; and  
10 depositing a free layer adjacent the pinned layer, the free layer having a free  
11 layer magnetization perpendicular to the pinned layer magnetization in the absence  
12 of an external field.
- Some as product*

- Sub C1*
13. The method as recited in claim 12, wherein the upper layer has a thickness of  
at least 4 Å.

- Sub A4*
14. The method as recited in claim 13, wherein the upper layer has a thickness of  
no more than 20 Å.

- Sub C1*
15. The method as recited in claim 12, wherein the upper layer is doped.

- Sub C1*
16. The method as recited in claim 12, wherein the underlayer includes NiFeCr.

*Subpart*

- 1    17. A spin valve (SV) sensor comprising:  
2        a pinned layer having a pinned layer magnetization;  
3        a free layer disposed adjacent the pinned layer, the free layer having a free  
4        layer magnetization perpendicular to the pinned layer magnetization in the absence  
5        of an external field;  
6        a spacer layer disposed between the free layer and the pinned layer;  
7        a pinning layer disposed adjacent the pinned layer for fixing the pinned layer  
8        magnetization, the pinning layer comprising PtMn;  
9        an underlayer disposed adjacent the pinning layer, the underlayer comprising  
10      NiFeCr; and  
11        an upper layer disposed adjacent the underlayer and the pinning layer, the  
12      upper layer comprising [CoFe] for increasing a GMR ratio associated with the SV  
13      sensor.      103

- 1    18. A spin valve (SV) sensor comprising:  
2        a pinned layer having a pinned layer magnetization;  
3        a free layer disposed adjacent the pinned layer, the free layer having a free  
4        layer magnetization perpendicular to the pinned layer magnetization in the absence  
5        of an external field;  
6        a spacer layer disposed between the free layer and the pinned layer;  
7        a pinning layer disposed adjacent the pinned layer for fixing the pinned layer  
8        magnetization, the pinning layer comprising PtMn;

9           an underlayer disposed adjacent the pinning layer, the underlayer comprising  
10        NiFeCr; and  
11           an upper layer disposed adjacent the underlayer and the pinning layer, the  
12        upper layer comprising NiFe for increasing a GMR ratio associated with the SV  
13        sensor.

*Subpart*

1     19.    A spin valve (SV) sensor comprising:  
2           a pinned layer having a pinned layer magnetization;  
3           a free layer disposed adjacent the pinned layer, the free layer having a free  
4        layer magnetization perpendicular to the pinned layer magnetization in the absence  
5        of an external field;  
6           a pinning layer disposed adjacent the pinned layer for fixing the pinned layer  
7        magnetization;  
8           an underlayer disposed adjacent the pinning layer, the underlayer comprising  
9        NiFeCr; and  
10          an upper layer disposed adjacent the underlayer and the pinning layer, the  
11        upper layer comprising a material selected from the group consisting of NiFe and  
12       CoFe for increasing a GMR ratio associated with the SV sensor;  
13          wherein the upper layer has a thickness between 4 Å and 20Å.

1     20.    A spin valve (SV) sensor comprising:

*Subj*

2        a pinned layer having a pinned layer magnetization, the pinned layer  
3        comprising a Ru layer with a first CoFe layer disposed adjacent a first side of the Ru  
4        layer and a second CoFe layer disposed adjacent a second side of the Ru layer;  
5              a free layer disposed adjacent the pinned layer, the free layer having a free  
6        layer magnetization perpendicular to the pinned layer magnetization in the absence  
7        of an external field, the free layer comprising a NiFe layer with a third CoFe layer  
8        disposed adjacent thereto;  
9              a spacer layer disposed between the free layer and the pinned layer;  
10          a pinning layer disposed adjacent the pinned layer for fixing the pinned layer  
11        magnetization, the pinning layer comprising PtMn;  
12          an underlayer disposed adjacent the pinning layer, the underlayer comprising  
13        NiFeCr; and  
14          an upper layer disposed adjacent the underlayer and the pinning layer, the  
15        upper layer comprising a material selected from the group consisting of NiFe and  
16        CoFe for increasing a GMR ratio associated with the SV sensor.

1        21.      A disk drive system, comprising:  
2              a magnetic recording disk;      *newt struc*  
3              a spin valve (SV) sensor including:  
4                  a pinned layer having a pinned layer magnetization;  
5                  a free layer disposed adjacent the pinned layer, the free layer having a  
6                  free layer magnetization perpendicular to the pinned layer magnetization in  
7                  the absence of an external field,

8            a spacer layer disposed between the free layer and the pinned layer,

9            a pinning layer disposed adjacent the pinned layer for fixing the

10          pinned layer magnetization,

11            an underlayer disposed adjacent the pinning layer, the underlayer

12          comprising NiFeX, and

13            an upper layer disposed adjacent the underlayer and the pinning layer,

14          the upper layer comprising a material selected from the group consisting of

15          NiFe and CoFe for increasing a GMR ratio associated with the SV sensor;

16          an actuator for moving the SV sensor across the magnetic recording disk so

17          the SV sensor may access different regions of magnetically recorded data on the

18          magnetic recording disk; and

19            a controller electrically coupled to the SV sensor for detecting changes in

20          resistance of the SV sensor.